Preface

This short book is based on lecture notes of a course on statistical physics and thermodynamics, which is oriented, to a certain extent, toward electrical engineering students. The course has been taught in the Electrical Engineering department of the Technion (Haifa, Israel) ever since year 2013. The main body of the book is devoted to statistical physics, whereas much less emphasis is given to the thermodynamics part. In particular, the idea is to let the important results of thermodynamics (most notably, the laws of thermodynamics) to be obtained as conclusions from the derivations in statistical physics.

Beyond the variety of central topics in statistical physics that are important to the general scientific education of the electrical engineering student, special emphasis is devoted to subjects that are vital to the engineering education concretely. These include, first of all, quantum statistics, like the Fermi–Dirac distribution, as well as diffusion processes, which are both fundamental for deep understanding of semiconductor devices. Another important issue for the electrical engineering student is to understand mechanisms of noise generation and stochastic dynamics in physical systems, most notably, in electric circuitry. Accordingly, the fluctuation–dissipation theorem of statistical mechanics, which is the theoretical basis for understanding thermal noise processes in systems, is presented from a signals-and-systems point of view, in a way that would hopefully be understandable and useful for an engineering student, and well connected to some other important courses learned by students of electrical engineering, like courses on random processes. The quantum regime, in this context, is important too and hence provided as well. Finally, we touch very briefly upon some relationships between statistical mechanics and information theory, which is the theoretical basis for communications engineering, and demonstrate how statistical–mechanical approach can be useful for the study of information–theoretic problems. These relationships are further explored in [1], and in a much deeper manner.

In the table of contents below, chapters and sections, marked by asterisks, can be skipped without loss of continuity.

Technion City, Haifa, Israel — Neri Merhav

Reference

1. N. Merhav, Statistical physics and information theory. Foundat. Trends Commun. Inf. Theor. **6** (1–2), pp. 1–212, 2009.

http://www.springer.com/978-3-319-62062-6

Statistical Physics for Electrical Engineering
Merhav, N.
2018, XII, 137 p. 21 illus., 3 illus. in color., Hardcover
ISBN: 978-3-319-62062-6